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Travellers with Special Needs
Modular Transfer Platform
Design Concept

for

Transportation Development Centre
Transport Canada

by

Uwe Rutenberg, Michael Barber
Les Designers Douglas Ball Inc.

November 1982

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17. Abstract

This report presents a design concept of a modular platform for the transfer of mobility disadvantaged or elderly travellers and their hand baggage, wheelchair or other mobility aids in transportation terminals.

The unique design features a low basic platform of lightweight aluminum or reaction molded urethane construction set on four swivel casters. A tubular hand rail, complete with optional folded seat, armrests, wheelchair securement arms and seat back assembly, can be attached to the platform. The hand rail can be used to manually propel the platform and, with optional modules, can accommodate either a seated ambulatory person or be used to secure a wheelchair-bound passenger on the platform. Access and egress for wheelchair passengers to the platform is achieved by side ramps. Several platforms can be linked together and be propelled by an electrically-powered drive-wheel unit operated by either the platform occupant or a walking attendant.

The platform converts into a baggage cart for carrying hand baggage, containerized collapsible wheelchairs, electric wheelchairs and batteries, etc., when the hand rail is in the horizontal position. A full scale mock-up was constructed to demonstrate the design concept.

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17. Résumé

Ce rapport présente le concept d'un véhicule modulaire pour le transport des voyageurs à mobilité réduite (handicapés, vieillards, etc.), de leurs bagages à main, de leur fauteuil roulant ou de toute autre aide à la mobilité, à l'intérieur des installations terminales des services de transport.

Ce véhicule de conception tout à fait nouvelle se compose d'une plate-forme basse en aluminium léger ou en uréthanne, montée sur quatre roues pivotantes, et d'une rehausse tubulaire articulée servant à pousser le véhicule et pouvant être équipée des éléments suivants: siège rabattable, bras d'appui, dossier et dispositif d'immobilisation de fauteuil roulant. Muni des équipements facultatifs proposés, il peut assurer le transport aussi bien des voyageurs en fauteuil roulant que des handicapés ambulatoires, les premiers y ayant accès par une rampe latérale. Le concept envisagé permet d'atteler plusieurs véhicules pour former une rame qui serait mue au moyen d'un timon motorisé à traction électrique, commandé par le passager du véhicule de tête ou par un conducteur accompagnant.

Afin de transformer le véhicule en chariot de manutention pour le transport des bagages à main, des fauteuils roulants expédiés sous emballage protecteur, des fauteuils roulants électriques, des batteries de traction etc., il suffit de rabattre la rehausse tubulaire en position horizontale. Le contractant a construit une maquette grandeur réelle du véhicule proposé.

18. Mots-clés	19. Diffusion
Fauteuil roulant, plate-forme, manutention des bagages, véhicule de transport intérieur, handicapés, terminus.	Le CDT dispose d'un nombre limité d'exemplaires.

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SUMMARY

The observed lack of adequate facilities in Canadian transportation terminals to accommodate the growing population of elderly or physically handicapped persons prompted the submission of an unsolicited proposal to Transport Canada, entitled "Transfer Facilities for Travellers with Special Needs". The project was sponsored by the Transportation Development Centre of Transport Canada as part of its program to improve access to the national transportation system for travellers with special needs.

A design concept of a modular transfer platform for the transfer of mobility disadvantaged travellers and their hand baggage, wheelchair or other mobility aids in transportation terminals is described in this report. The companion report published under this project is "Travellers with Special Needs - Facility Design Compendium (illustrated)".

Three alternative approaches to a vehicle design were considered. The two-passenger (seated in parallel) plus driver and the two-passenger (seated in tandem) plus driver configurations were discarded due to excessive size. A smaller, modular platform system with a separate motorized drive-wheel unit was chosen as the concept worth developing.

This unique design consists basically of a low platform of a light-weight construction (e.g. aluminum frame with wire mesh floor or complete platforms of reaction molded urethane). Four swivel castors would be fixed to the underside of each platform.

A tubular hand rail can be attached to each platform in either a raised or lowered position. In the raised (vertical) position, this versatile hand rail can be used to push the platform manually. When the platform is used for the conveyance of travellers, elements such as an extra-wide seat, hinged seat back and arm rests are an integral part of the hand rail frame. These parts are unfolded to support the ambulatory and semi-ambulatory traveller who is not able to walk long distances. Another important item within the hand rail, is a wheelchair restraint (tie-down) for wheelchair-bound travellers who prefer to remain in their chair. Hinged ramps on either side of the platform are used for the access and egress of such travellers. When the hand rail is in the lowered (horizontal) position, the platform converts into a baggage cart for carrying hand baggage, containerized collapsible or electric wheelchairs and batteries, etc. Several platforms can be linked together and be propelled either by an electrically-powered drive-wheel unit operated by the platform occupant or a walking attendant.

A full scale mock-up of the modular transfer platform was constructed to demonstrate the design concept. However, actual prototypes would be required to be built and tested in service conditions to verify the design.

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1. INTRODUCTION

1.1 General

The lack of adequate special facilities in terminals to cater to the mobility disadvantaged travellers, now approaching one million in Canada and growing at double the rate of the overall population, has been a question of concern to the transportation handicapped community.

In particular, certain inadequacies in existing airport facilities, have prompted a number of letters of complaints to the minister since the summer of 1977. A sampling observation in major airports and train stations in January/February 1982, by Les Designers Douglas Ball Inc., as part of a Facility Design Compendium, revealed inadequate transfer facilities within the terminals. A design concept for a modular transfer platform evolved from these observations.

1.2 Objectives

The overall objective is to improve access to our national transportation system for the Canadian population with special needs.

The specific objective is to provide a conceptual design of a modular transfer platform for the transport of mobility handicapped persons within air, rail or ferry terminal complexes.

2. DESIGN PROCESS

2.1 Present Operations

Passenger carriers are currently using the standard wheelchair as their main element of transfer within the terminal. A chair is provided to people who are elderly, temporarily injured or unable to walk, as well as those individuals who are required to transfer from their own wheelchair. Very often these wheelchairs have no self-propelling features; therefore, the assistance of an attendant is necessary.

2.1.1

The increasing travel demand by the mobility disadvantaged population has necessitated both an increase in the number of wheelchairs and attendants' time for the handling of these passengers in terminals. Carrier-owned wheelchairs are mostly non-collapsible for safety and handling reasons, thereby creating problems with maintenance and storage space as well as being labour-intensive, inasmuch as one attendant is required to move even an empty chair.

2.1.2

All travellers have one problem in common; to get from point A to point B within the terminal with comfort, ease and often in a short time.

Terminals are divided into a public area and a security area. Beyond the security gates only passengers, service and other authorized personnel are permitted. For the mobility disadvantaged passenger this is an important factor, because he/she can rely in the public area on some help from friends, relatives or other companions. In the security area, however, he/she is almost completely reliant on assisting personnel.

2.1.3

At terminal II in Toronto International Airport, two electric transfer vehicles are used to drive passengers to the gates. Neither one is accessible for either wheelchair users or for people who have difficulties in negotiating steps.

2.1.4

In summary, based on the above facts (supplemented by firsthand observations of simulated passenger transfer by all representative groups of special needs travellers in three different airports, train and bus stations), there is an obvious need for improving the equipment and reducing labour necessary for transfer within the terminal complex.

2.2 Transfer Vehicle Rationale

The mobility disadvantaged do not only consist of wheelchair users. The target population consists of the elderly, ambulatory, obese, mother with child, their hand baggage and mobility aids. While such travellers have different needs, they share a number of common problems that limit their ability to transfer. Some have physical difficulties performing tasks, such as: walking long distances, standing, climbing or descending steps and stairs, carrying weights up to five kilograms or just reaching, handling or grasping.

Others have perception problems, such as seeing, distinguishing colors, hearing signals, or are not able to orientate at all, like a blind person without a guide dog.

Attitudinal aspects play an important role as well. The mobility disadvantaged passenger often avoids public transport not only because of a lack of transfer facilities, but because of the attached stigma of using a wheelchair, the need to move quickly and unprotected in moving crowds, the feeling of dependence and the pressure to meet schedules.

Physical tasks such as handling baggage and walking long distances in the public area often require assistance. This assistance could be provided by a platform system in lieu of ground personnel (e.g. red caps, ground hostesses, etc.). Relatives and friends often accompany these passengers in the public area and could handle these platforms similar in size to the baggage carts presently in use. This would increase mobility for these passengers to washrooms, shops and restaurants.

In the security area the potential is even greater. Adding a motor unit to several platforms would increase the productivity of attendants and reduce the space of lined up wheelchairs in favour of stacked lightweight platforms.

From the ticket counter or departure lounge, both wheelchair passengers and wheelchairs in containers could be driven to the aircraft or train by a single person without strenuous physical effort of carrying heavy baggage. On the return trip, several empty platforms could be linked together to save manpower.

2.3 Initial Approach

The initial approach concentrated on a vehicle for two passengers, side by side, and a standing driver (one passenger being a wheelchair traveller, the other using the seat). The standing driver would use minimal space and the vehicle would be powered by batteries. The smallest possible space in this configuration was still too large to pass through some elevator doors; and in two-way traffic in a corridor it might interfere with traffic flows. It also required a permanent driver, whenever in use. The weight of the driver would have been additional to the vehicle. (Fig. 2.3.1)

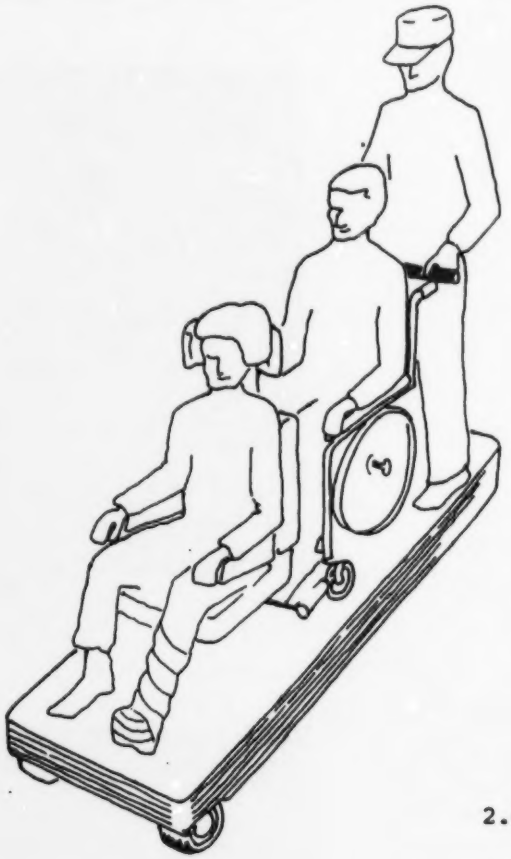
2.4 Alternative Approaches

The next obvious step was to reduce the dimension and sit two travellers, one behind the other, thus making the platform longer (which would often be used by one passenger only) but still requiring a driver (Fig. 2.4.1). This linear configuration proved too inconvenient and therefore had to be reduced to more compact elements, using the wheelchair as the equipment by which many facilities are designed, such as; doors, elevators, ramps, etc. The power element should be detachable from the platform, allowing the platform to be more manoeuverable, modular and cost effective. Wheelchair travellers could be assisted or they would access onto the platform by themselves; the power element could be hooked to the platform and would then drive the combined elements. (Fig. 2.4.2)

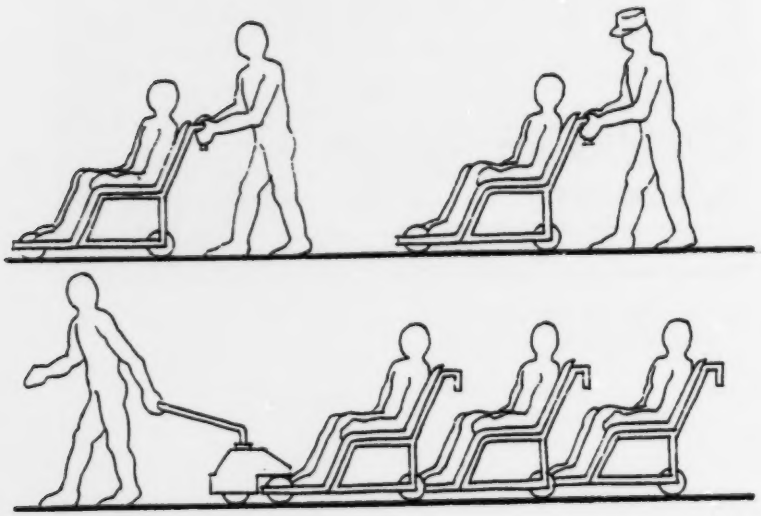
For travellers not using a wheelchair, a chair could be attached to the platform and allow them to drive, when physically and mentally capable. Tests have to determine if these self-driven units would be in agreement with the carrier policies for reasons of safety and liability.

The platform can be handled by service personnel, but not only on a one to one basis (Fig. 2.4.3). Two or three platforms can be linked together, the service attendant pulling them with the power unit, thus reducing manpower requirements and physical effort by up to two thirds.

2.3.1

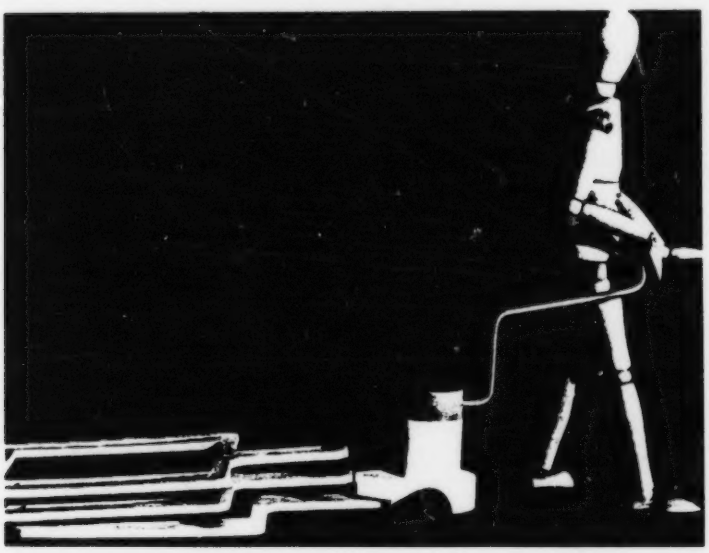


2.4.1

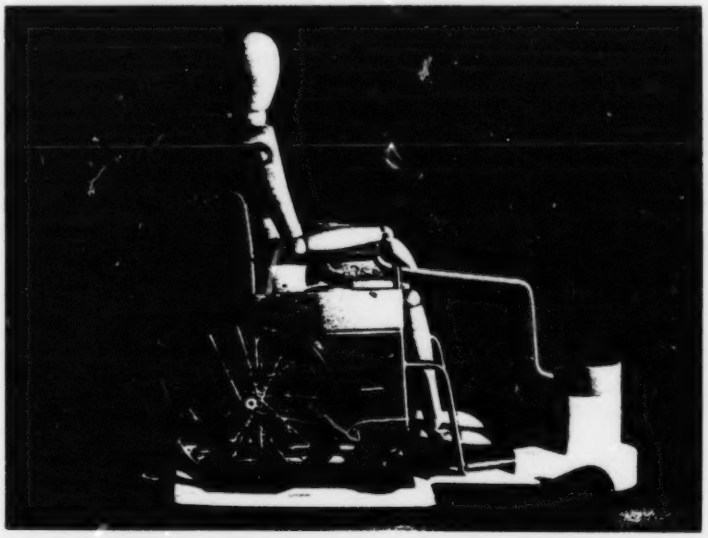


2.4.2

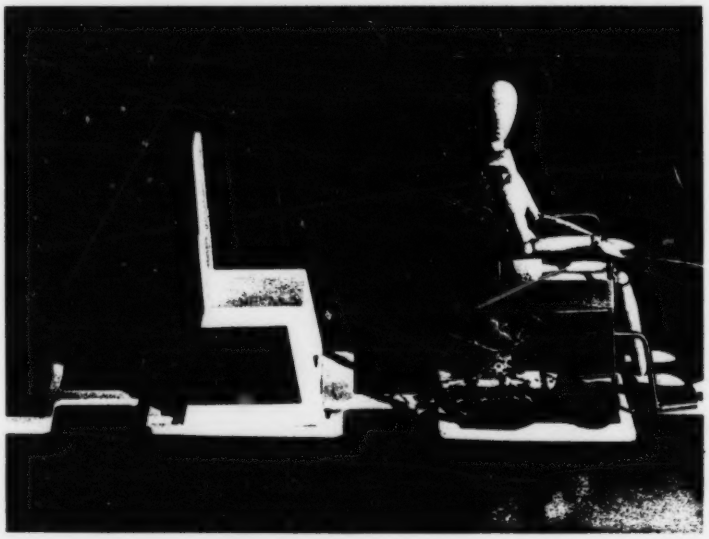
Platform driven by carrier personnel. 2.4.3



Empty platforms are stacked and brought back to ticket counter. 2.4.4



Platform driven by wheelchair user. 2.4.5



Platform with wheelchair user and special seat for ambulant passengers. 2.4.6

On the return trip to the ticket counter, the empty platforms could be stacked, therefore, reducing storage space and manpower. (Fig. 2.4.4)

A further refinement to this concept was developed, which incorporated a permanently fixed, folding seat on each platform. This seat would be wider than normal and could therefore be used by an obese person, a mother with a small child, or a person with crutches, etc. (Fig. 2.4.6)

At this stage of the development, it was also found that wheelchair access to the platform from either side was necessary rather than end access, especially when platforms are linked together and the person occupying the middle platform wants to egress without disturbing the other platform travellers.

There are two elements which form this new concept:

a) Power unit with tiller control.
b) Modular platform.

3. FINAL DESIGN

a) Power Unit

The small and compact motorized unit is driven by two 12-volt gel-cell batteries, located over one powered wheel. The semi-pneumatic (200 mm) wheel is directly driven by a compact, efficient motor. A receiving hook on each end allows for linking to a platform. An adjustable tiller, with controls for speed and direction, can be used by a person when seated on the platform or from the opposite side by a walking attendant. When not in use, the unit can be plugged in at a recharging point.

b) Modular Platform

The platform is of a very simple and lightweight construction (e.g. aluminum or reaction molded urethane) and only 80 mm above ground.

It forms the base for a variety of applications which are determined by terminal size and travel sequence:

Platform for equipment (e.g. wheelchair in container)

The basic platform consists of a frame, a wire mesh floor (or one piece molding), four castors and a hand rail. It can be used to transport wheelchairs, which are packed in containers, and can be pushed or driven by a motor unit.

Platform for wheelchair passenger

This platform has access ramps on both sides to accommodate one wheelchair. Two telescopic tie-down arms, to secure the wheelchair, adjust to most wheelchairs including electric wheelchairs from 200 mm to 630 mm wheel diameter. Hand luggage can be stored on the left and right of the chair.

Platform for ambulatory (e.g. obese, mother and child)

Consists of an extra wide seat (76 cm), backrest and armrests that swing out from the hand rail to accommodate obese passengers or a mother with a small child. For elderly or ambulatory passengers, with aids such as canes, crutches, etc., storage is provided on the platform.

Platform for two adult passengers

A double seat for two adult passengers can be added to the platform, lengthwise, specially for terminals where senior citizen charter flights form a regular base. Their hand luggage can be stored underneath the seat.

Some of the most important features of the modular concept are:

- All elements of the system are extremely compact and lightweight (e.g. frames, wire mesh floors and hand rail).

- The low platform allows easy access and egress from the sides. This is especially important when several platforms are linked together and the first in line wants to egress first.

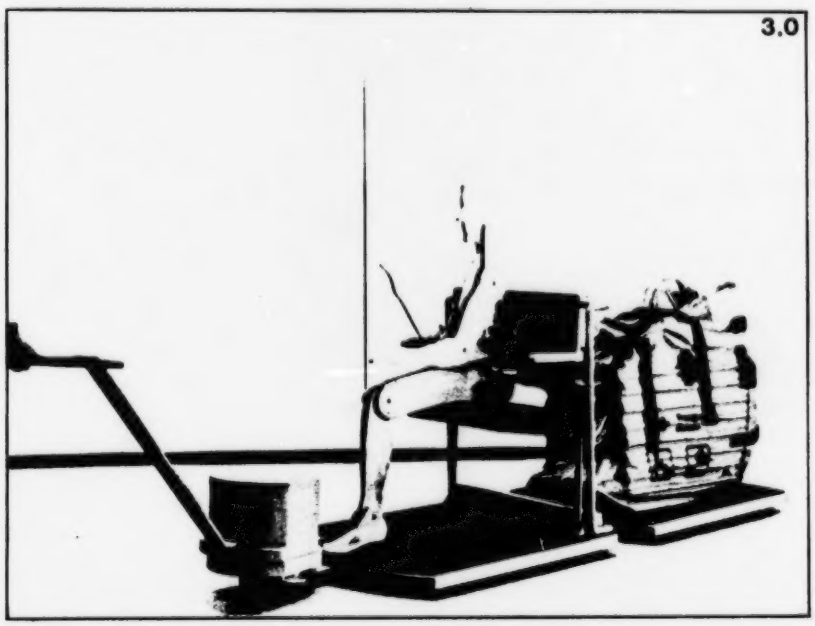
- Modular components allow for a great versatility of applications (e.g. hand rail, seat, back, armrests, basket, etc).

- Visual appearance is more acceptable to passengers who do not want to be identified with the wheelchair stigma.

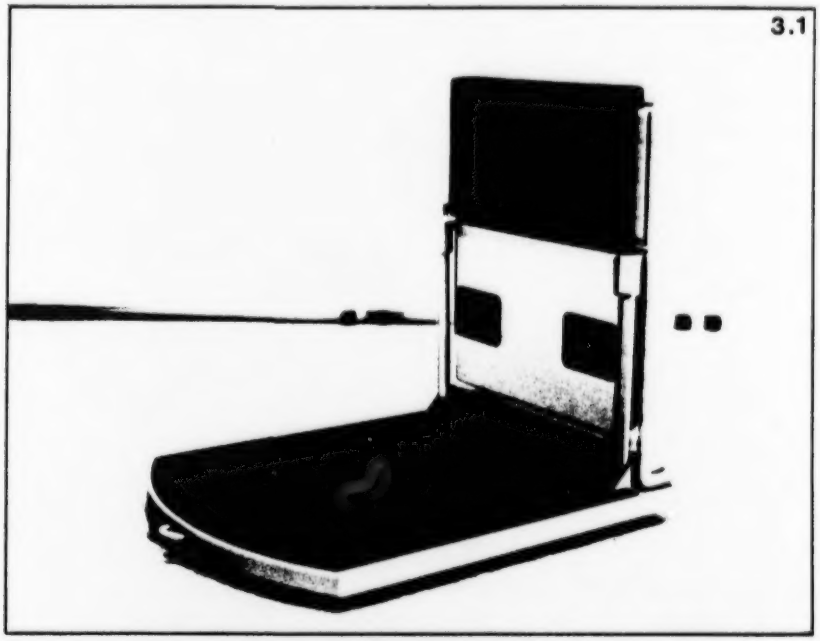
- Its great potential for the transfer of passengers, special equipment, baggage and related activities makes this concept a prime candidate for further development.

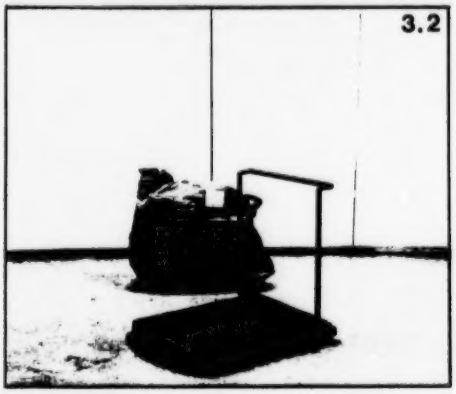
Preliminary design drawings of this concept can be found in Appendix A.

Modular Transfer Platform

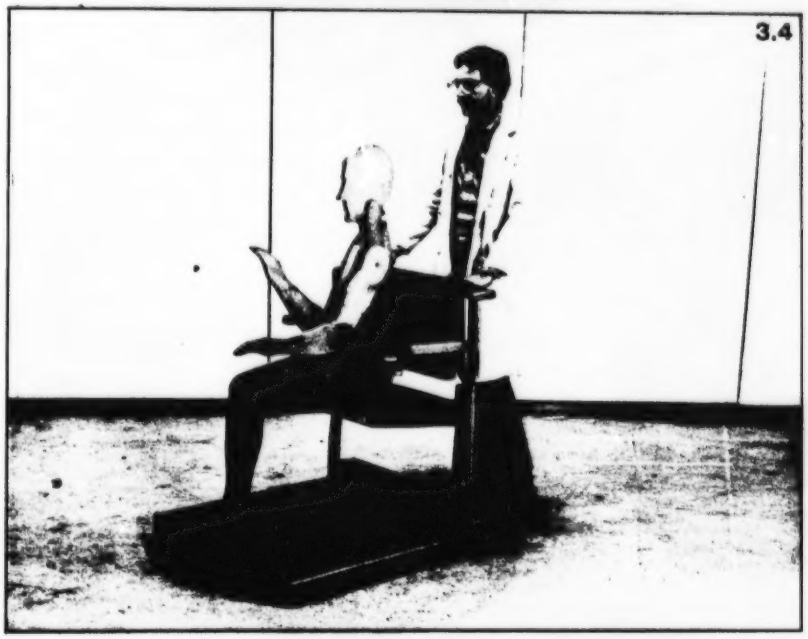


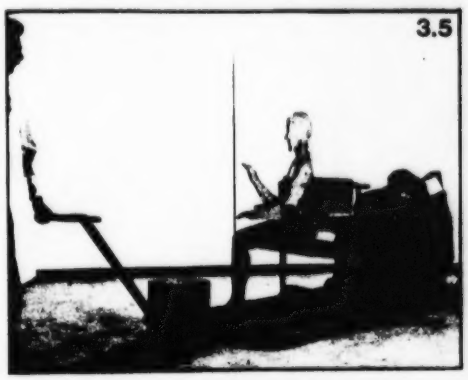
3.0 Motor unit, platform with seat and back, and basic platform

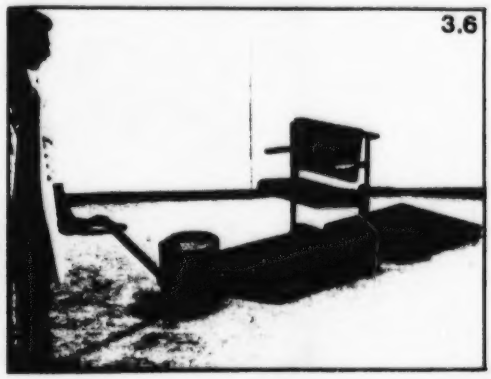




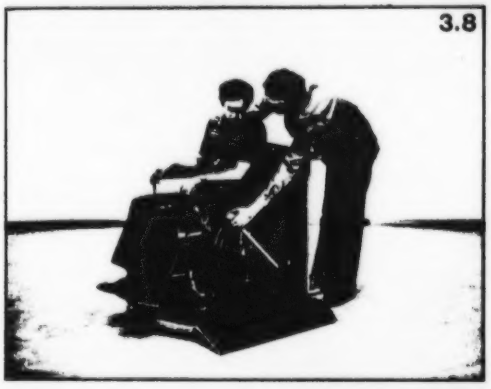
3.1 Platform with folded seat and backrest
3.2 Platform with hand rail

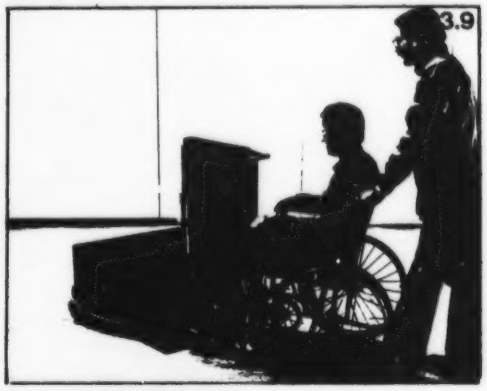


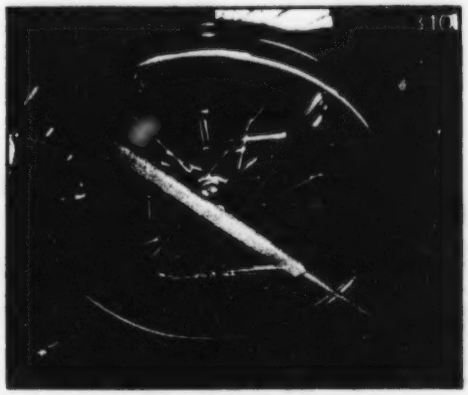




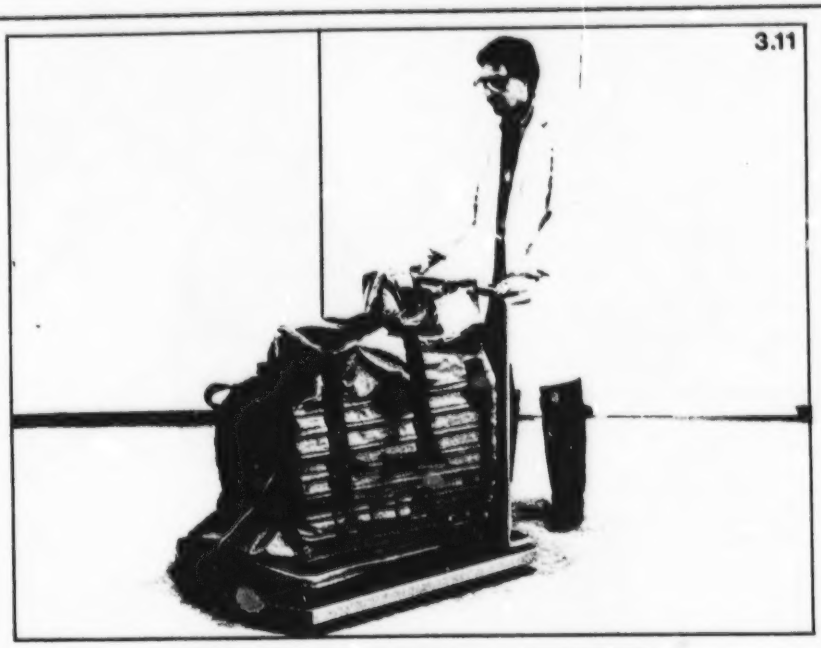
3.3 Ambulatory passenger driven by attendant
3.4 Ambulatory passenger pushed by companion
3.5 Several platforms driven by attendant with passenger, baggage
3.6 Empty platform on return trip

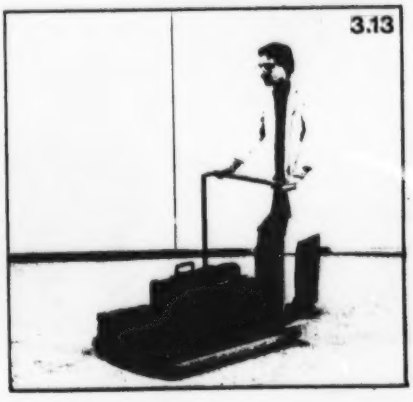


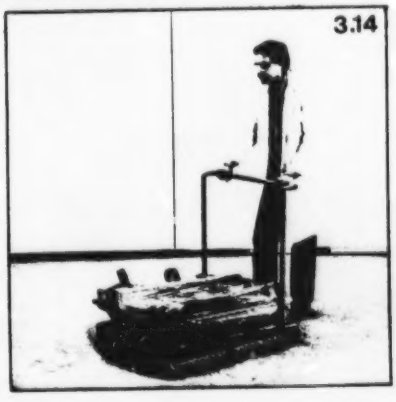




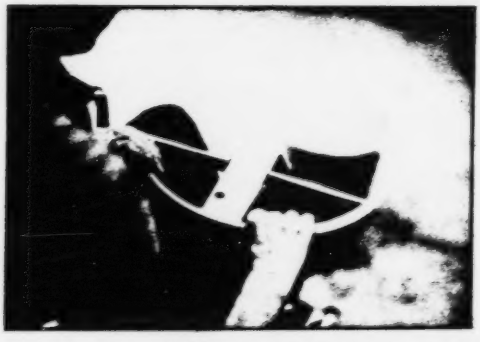
3.7 Wheelchair passenger driven by attendant
3.8 & 9 Egress of wheelchair by side ramps
3.10 Wheelchair securement built into underside of seat

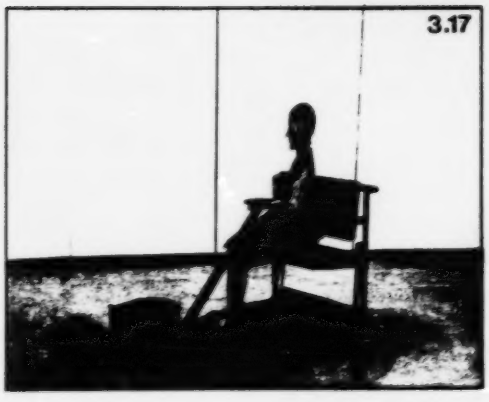


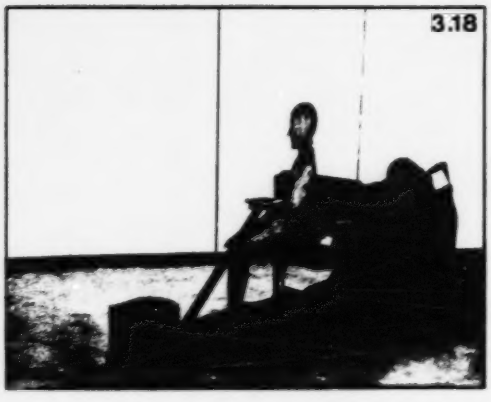




3.11 Wheelchair in container pushed manually
3.12 Same; driven by attendant with motor unit
3.13 & 14 Baggage pushed manually







3.15 Wheelchair passenger driving motor unit
3.16 Tiller with speed control
3.17 & 18 Ambulatory passenger driving motor unit

4. PLATFORM VEHICLE APPLICATIONS

A motorized transfer platform consists of two elements: a battery-powered motor unit with steering, speed and direction (forward and reverse) controlled by a tiller; and a multi purpose platform.

The motor unit can be operated from either a seated position on the platform or from a walking position, in front of the motor unit, with the platform behind.

The platform is intended for use by travellers in wheelchairs, with access available on either side. The wheelchair can be secured when on the platform.

For ambulatory and semi-ambulatory passengers, an extra wide seat, on the same platform, can be swung out to accommodate them, their aids and their baggage.

In its simplest form the platform has a hand rail for the transport of folding and non-folding wheelchairs and can either be pushed or driven (when motor unit is attached).

These transfer platforms would be under the control of either the carriers or the terminal authorities so as to improve service to the special needs travellers. The transfer units would be obtainable by this particular group of travellers only by presenting either their tickets or a special pass.

The places suggested for the operation of these untis are: (internally) in the public area and in the "passenger only" area. Platforms would be available in both areas, whereas motor units would be only available beyond the security gate by authorized personnel.

Ambulatory passengers in the public area with time to spend could use a platform (without the motor unit) to be pushed by relatives, companions or other passengers in order to use the terminal facilities. For passengers who have no companion and would like to, or must, proceed to the transportation mode immediately, an authorized attendant with motor unit and platform would pick them up from the terminal entrance and drive, on a direct route, to the gate.

To minimize manpower for the transport of empty platforms, several platforms can be linked and driven by one attendant with a motor unit.

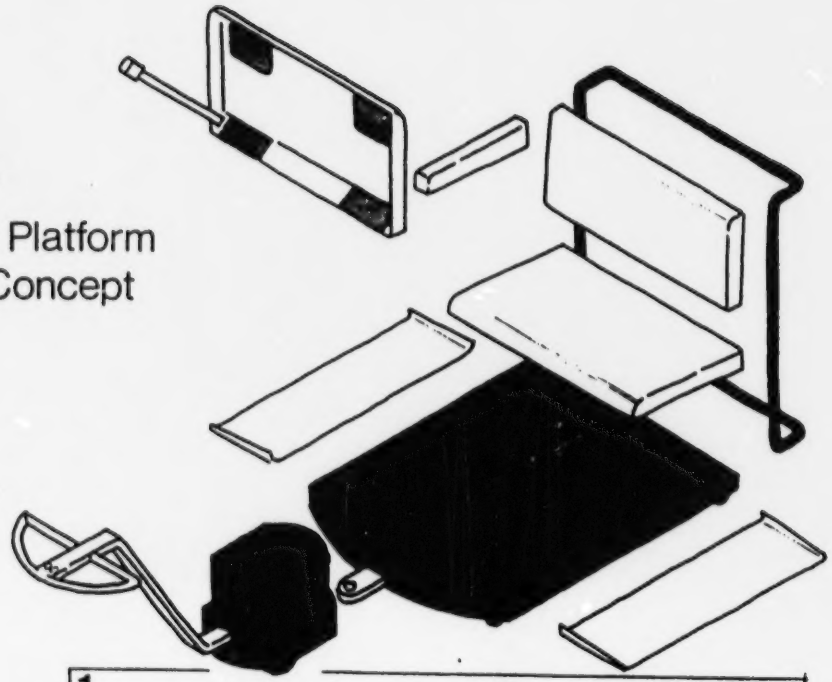
Another procedural possibility envisages that wheelchair users or ambulatory people be employed to operate the system. This would increase the awareness and understanding towards the special needs traveller.

However, only the testing of the operation will show the effectiveness and interaction with this system throughout the terminal complex. The intended operation of the motor unit is initially by carrier personnel.

Due to the simplicity in design and operation it has the potential to be driven by physically and mentally capable special needs travellers (e.g. wheelchair users able to use hands and arms, people using crutches and canes, elderly with limited walking capabilities, etc.).

Travellers with Special Needs

Modular
Transfer Platform
Design Concept



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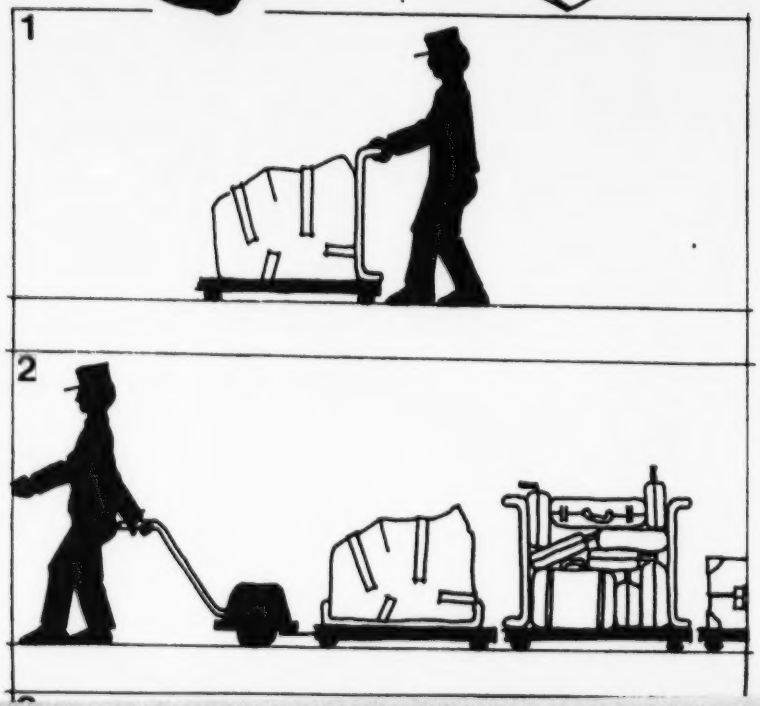
Traveller



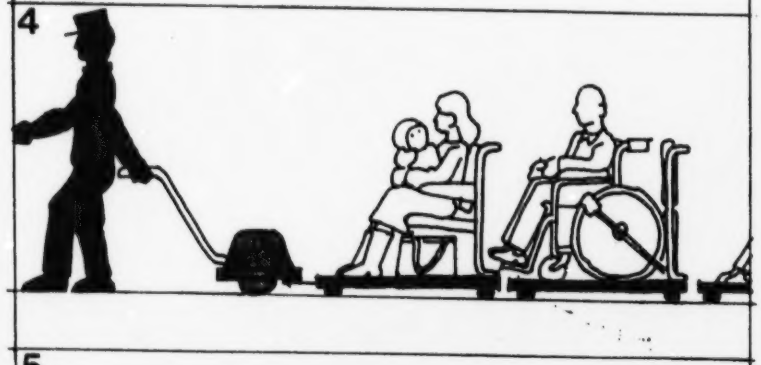
Carrier

Basic platform used by personnel to manoeuver large items eg. baggage, crates, etc.

Loaded platforms linked together and pulled using motor unit, controlled by attendant.

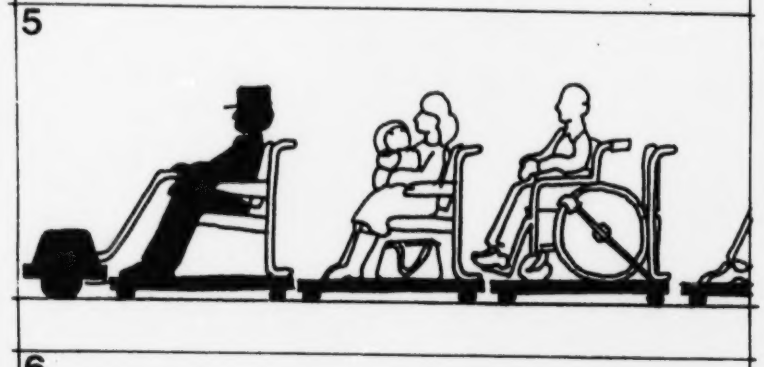
Platform and seat pack used by special need traveller, pushed by companion (used in public area).

Special need travellers are seated throughout transfer.

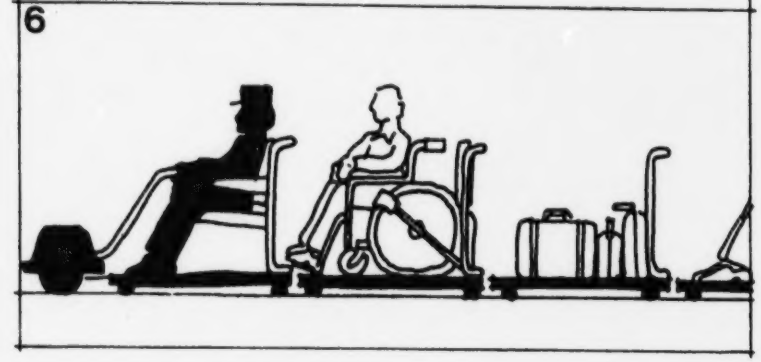


Platforms with combination seat pack/wheelchair tie-down, linked together and pulled using motor unit, controlled by attendant (used in passenger only area).

Special need travellers are seated throughout transfer - hand baggage can be taken along on platform.



For long distances, linked platforms can be driven by attendant in seated position to assist in transfer of all special need travellers.



On arrival, from gate end of terminal, both special need travellers and all baggage can be taken by attendant to customs control and/or to connect with waiting transport.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

It is felt that the modular transfer platform which has been designed would offer many advantages not only for the different mobility disadvantaged travellers, but for the carriers as well.

For the mobility disadvantaged it would help eliminate transfer problems such as: walking long distances, carrying hand baggage and mobility equipment, feeling of dependence and moving in crowds.

For the carriers it would be cost-beneficial through productivity gains, since one attendant could handle up to three passengers, instead of just one. It would increase service to the mobility disadvantaged population and make the national transportation systems more accessible to all travellers.

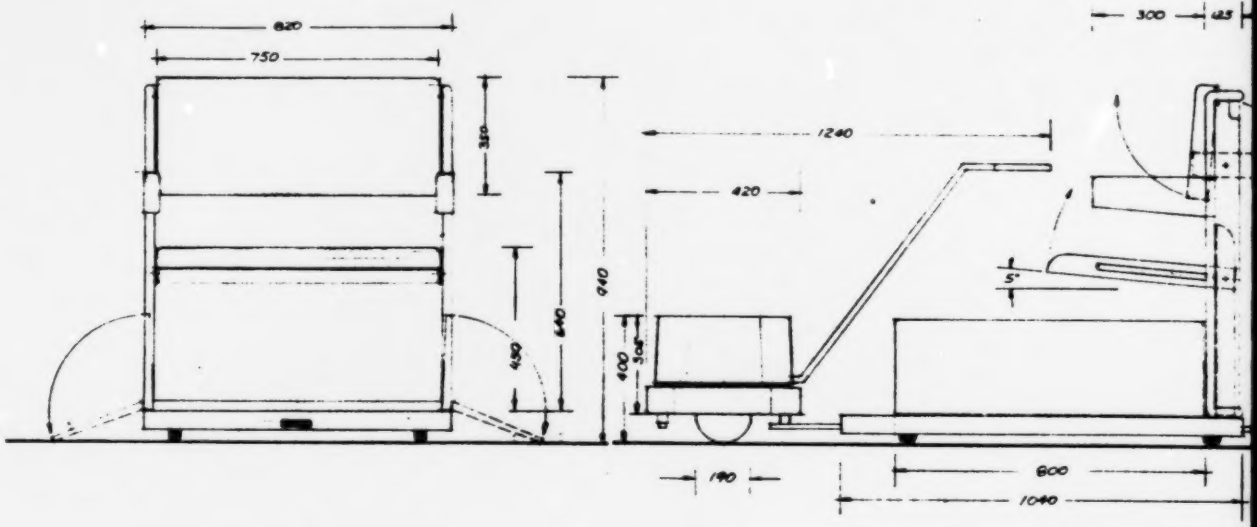
5.2 Recommendations

We recommend that consideration be given by major carriers (Air Canada, VIA Rail Canada Inc., CP Air, etc.) to acquire one or more transfer platforms (working prototypes) and to test the effectiveness of the system design under actual service conditions. If found successful, it is suggested that use of the equipment should be implemented in major terminals such as Toronto Union Station, Dorval Airport, Toronto Airport Terminals I and II, etc.

We recommend the transfer platform design be further developed by constructing and testing prototypes.

A work plan for the next phase is included as Appendix B.

APPENDIX A - PRELIMINARY DESIGN DRAWINGS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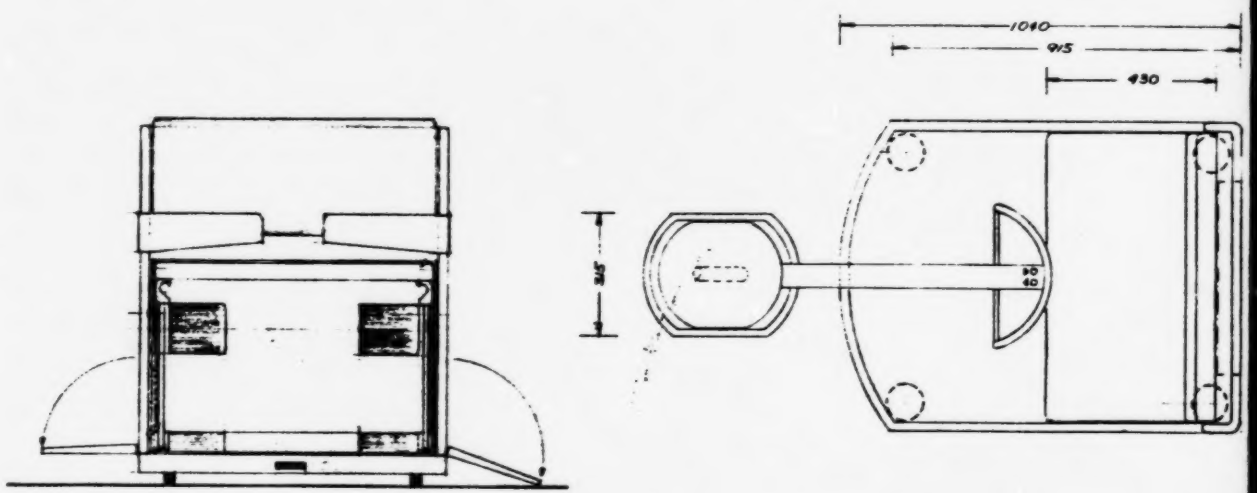
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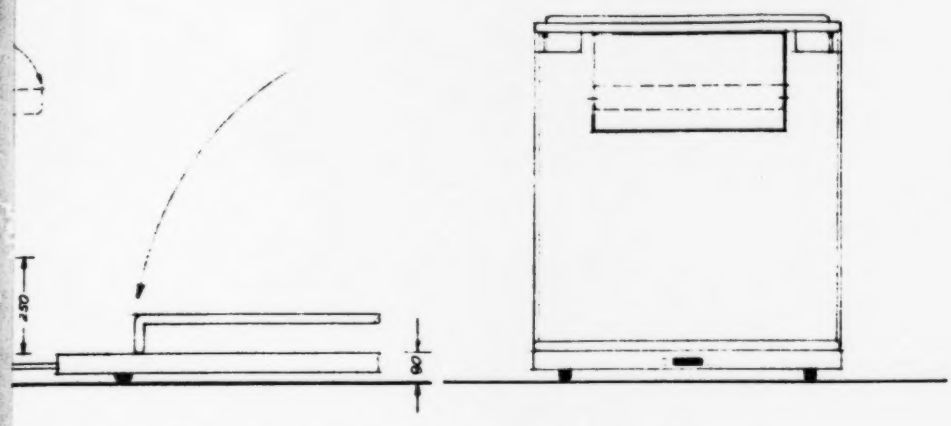
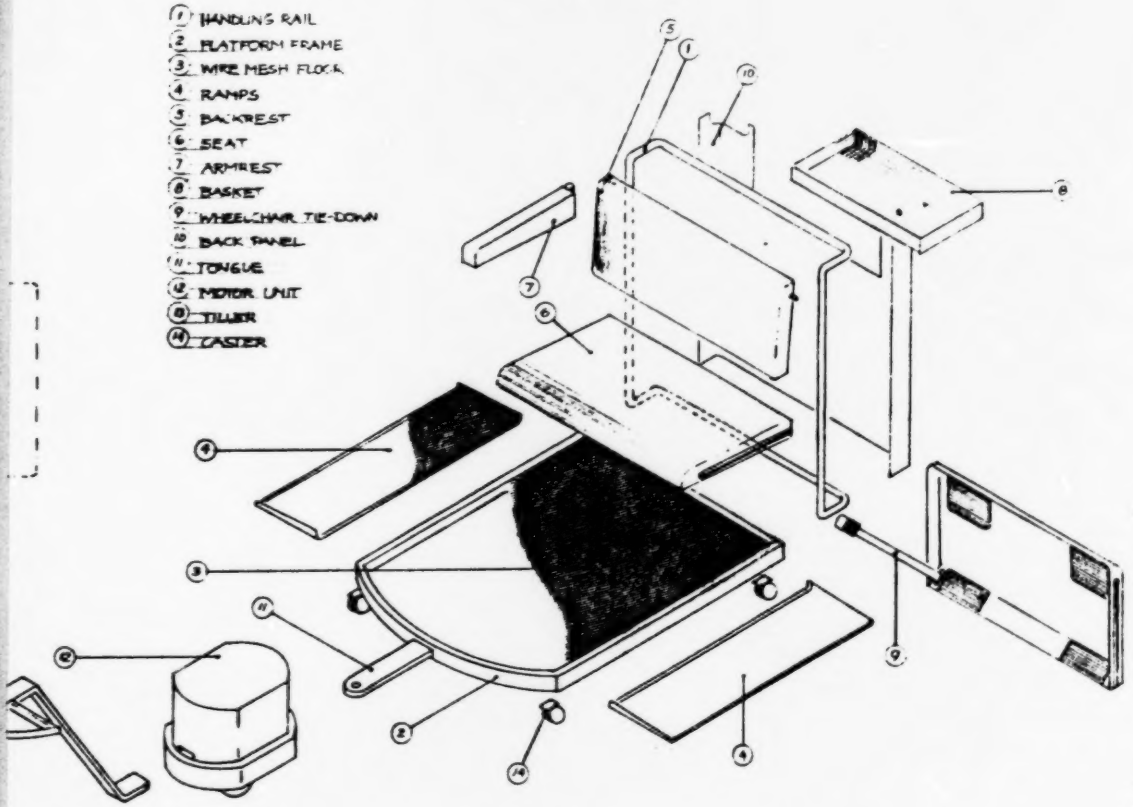


1. HANDLING RAIL
2. PLATFORM FRAME
3. WIRE MESH FLOOR
4. RAMPS
5. BACKREST
6. SEAT
7. ARMREST
8. BASKET
9. WHEELCHAIR TIE-DOWN
10. BACK PANEL
11. TONGUE
12. MOTOR UNIT
13. TILLER
14. CASTER



ALL DIMENSIONS IN mm

LES DESIGNERS
DOUGLAS BALL INC.

MODULAR TRANSFER PLATFORM (TDC)

PRELIMINARY LAYOUT

U RUTENBERG, M. BARBER

M.B

1/4" - 1/32"

JULY 1982

APPENDIX B - PHASE II WORK PLAN

1. Prepare detailed work plan, budget and schedule.

2. Prepare working drawings for prototype construction.

3. Prepare system component specification.

4. Build three complete platforms, one equipped for wheelchair passenger use, one for ambulatory persons and one for baggage, with one motorized unit.

5. Perform functional test of system components in-house.

6. Make prototype units available to Transport Canada or carriers for purpose of field tests in transportation terminals.

7. Monitor and support testing (repairs, modifications, etc.).

8. Report and evaluate test results.

9. Implement necessary design changes and produce final manufacturing drawings and specifications.

10. Document the project in a report complete with illustrations, photographs and drawings.

APPENDIX C

REVIEW COMMITTEE COMMENTS ON TRANSFER PLATFORM DESIGN CONCEPT.

This represents a summary of comments from the steering committee members.

From the air carriers' perspective (Brian Wright, Air Canada):

"The concept is viewed as a very positive step in the right direction. There appears little question that downline, the carriers will be unable to provide one on one handling to special passengers and must therefore view any alternatives with great interest."

"On the positive side, the modules appear to have easy access with boarding ramps to assist where necessary. The proposed speed is slow enough to ensure a high margin of safety. It should be easy to drive and/or push manually and pretends various combinations depending on the needs presented at any one time."

"The transportation of baggage and the possibility of combining a number of unaccompanied minors are also considered good features."

"On the less favourable side, we have difficulty in visualizing more than one module operating through most airports."

Suggestions:

a) A small barrier around the front leading edge of the wheelchair would be required to ensure the front wheels would not roll off the vehicle.

b) A more accessible means of turning the wheelchair on the module would be needed preferably so that it could be turned from behind and not in front.

c) Additional aids are needed to facilitate hold on a downward slope when being used without power assistance.

"In summary, we foresee a definite need for a vehicle to transport special handling passengers from the check-in counter area to the gate."

From the train carriers' perspective (Richard Jardine, VIA Rail Canada Inc.):

"The overall concept and design was well received indicating that with revisions the transfer vehicle could very well serve as a useful piece of equipment to VIA."

"The uses that we would see for this vehicle with modifications is that of handling people and baggage on platforms where great distances are often travelled to board trains, especially at mid-size stations."

"Another use for such a vehicle was the possibility of handling food supplies to and from our C.D.C. areas."

"Because of the short distances within our terminals, this vehicle would serve little or no use inside the stations."

Suggestions:

a) Power unit and trailer would require a six-inch (6") clearance for easy mobility.

b) Trailer in many cases, with the exception of the one to carry passengers, would need to have more capacity.

c) Some concerns were expressed as to the traction and power of the power unit and that it would most definitely require two wheels with a third stabilizing wheel.

d) The steering mechanism, if designed with a handle of sufficient strength, could be used to apply additional pull by operator in snow conditions or under excessive loads.

"Over all I would suggest that the concept of the vehicle might very well serve as a useful tool if the above suggestions are incorporated and that VIA would be more than happy to test a working prototype."

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From the ergonomist's perspective (Dr. Ruth Heron, Transportation Development Centre):

"The transfer platform system could be extremely useful for transporting pre-board individuals complete with hand baggage to the plane door."

"The necessity of wheelchair occupants using airline wheelchairs characterized by sagging seats and backs, wobbly wheels and footrests rarely in the correct position for passenger comfort, would be eliminated."

"In order to avoid passenger perceptions of the vehicle operation as coulee-like, it is suggested that the attendant drive rather than pull the vehicle."

"The push-rail should be oriented at angle of greater than 90 degrees from the vehicle floor to avoid adverse pushing posture."

"It is possible that some elderly may have aversive reactions to a transfer vehicle which is associated with wheelchair use. The design of this vehicle is such as to minimize this association."

"The utility of the transfer vehicle can be realistically examined only when a prototype is built and submitted to carefully designed field tests. Such tests would reveal not only whether the concept is viable, but also, if so, which aspects of the design must be modified in order to render it ergonomically efficient for both passenger and materials handling.